does not exist the least specific difference between *B. Gunni* and *B. Tasmanicus*, the last name will have to be laid aside.

Length of specimen 33 millemetres.

On the Edible Oysters found on the Australian and Neighbouring Coasts.

By J. C. Cox, M.D, F.L.S., &c.

Some years ago I read a paper before the Acclimatization Society of New South Wales, on "The Oysters and Oyster Beds of New South Wales," which was published in the columns of the *Sydney Morning Herald*. In it was embodied all the information I then possessed on the different species of Oysters found on our coasts, and it went fully into the different varities of the same species which were found at most of the beds that were then being worked.

Since then our knowledge of the different species found on this and the neighbouring coasts of Tasmania, New Zealand, Lord Howe's Island, and Queensland has so improved that it will not be uninteresting to many scientifically, and to others commercially, to have a condensed resumé of the species as now defined, published in our journal.

In 1867, Mr. G. F. Angas published in the Proc. Zool. Soc., London, a list of the species of Marine Mollusca found in Port Jackson, in which he enumerated four species of *Ostrea* as having been found there, (see page 934), namely, *Ostrea purpurea*, Hanly, *Ostrea mordax*, Gould, *Ostrea circumsuta*, Gould, and *Ostrea virescens*, Angas.

The same author, also in a valuable list of the Marine Fauna of South Australia, published in the Proc. Zool. Soc., London, for 1865, mentioned that two species of Oysters were found on

that part of our coast—*Ostrea edulis*, Linn., or a variety of it, and *Ostrea cucullata*, of Born.

The Rev. J. E. Tenison-Woods, in his "Census of the Marine Shells of Tasmania," records four species of Oysters as found on the Tasmanian shores, namely, *Ostrea edulis*, Linn., *Ostrea mordax*, Gould, *Ostrea rutupina*, Jeff., a variety of *O. edulis*, and *Ostrea Angasi*, Sowerby.

In Hutton's "Manual of New Zealand Mollusca," (Marine and Land Shells), published in 1880, I find recorded as found on the New Zealand coast four species, *Ostrea edulis*, Linn., *Ostrea discordia*, Gould, *Ostrea glomerata*, Gould, *Ostrea reniformis*, Sowerby.

In Reeve's "Monograph on the genus Ostrea," published in 1871, in Conch. Icon., I find that there are five species recorded as being found on the Australian Coasts, namely, *Ostrea myrtiloides*, Lam., *Ostrea virescens*, Angas, *Ostrea Angasi*, Sowerby, *Ostrea discordia*, Gould, and *Ostrea subtrigona*, Sowerby.

So that thirteen species have been recorded by these various authors as being found on our Australian Coasts proper, Tasmania, New Zealand, Lord Howe's and Norfolk Islands, two of which are considered only varieties of *Ostrea edulis*. They are as follows:

1. *Ostrea Angasi*, Sowerby.
2. ,, *circumsuta*, Gould.
3. ,, *cucallata*, Born.
4. ,, *discordia*, Gould.
5. ,, *edulis*, Linn.
6. ,, *glomerata*, Gould.
7. ,, *mordax*, Gould.
8. ,, *myrtiloides*, Sowerby.
9. *Ostrea purpurea*, Hanley, a variety of *O. edulis*, Linn.
10. *Ostrea reniformis*, Sowerby.
11. ,, *rutupina*, Jeff., a var. of *O. edulis*, Linn.
12. *Ostrea subtrigona*, Gould.
13. ,, *virescens*, Angas.

This does not include all the species which so far have been found on our shores, we shall have to add:

14. *Ostrea Cristagalli*, Linn.
15. *Ostrea imbricata*, Lam.

But it must not be supposed that, because we have had these fifteen species diagnosed and recorded as coming from our coast, that therefore, there really are fifteen species found here, the diagnosis made of these species has been very imperfect, and in most instances very incorrect. I propose therefore, to give what I consider a correct list of species which have been more recently determined as having been found here, at the same time to assist those who are engaged in studying our Oysters scientifically or commercially, to give the diagnostic characters of each species, and shall begin with those that are found on the coast of New South Wales proper; they are:

1. *Ostrea Angasi*, Sowerby; our Mud Oyster.
2. ,, *subtrigona*, Sowerby; our Drift Oyster.
3. ,, *glomerata*, Gould; our Rock Oyster.
4. ,, *circumsuta*, Gould; a rare species.
5. ,, *virescens*, Angas; also a rare species.

The two last are of no commercial value, being very rare, of small size and difficult to remove perfectly from the rocks to which they are attached.

1. Ostrea Angasi, *Sowerby*.

"Shell large, compressed, roundly subtrigonal, cinereous, a little purple towards the margin, inequi-valve, white within; lower valve thick, ribbed, its margin expanded, fluted, with bluish border; upper valve depressed, armed with broad, thin, smooth scales fluted towards the margin; muscular impression large in both valves."

The above is Sowerby's original description of this species as given in Reeve's Conch. Icon. An excellent figure of this species is given in Vol. xviii of Reeve's Conchologia Iconica, Mon. Ostrea plate xiii., Sp. 27, fig. 28, by mistake, it should be fig. 27.

This is the Mud Oyster found in Port Jackson and near the mouths of our rivers and harbours emptying themselves on the

East Coast of New South Wales. This is the species which Angas gave in his list of the species of Marine Mollusca, found in Port Jackson, already referred to in the Proc. Zool. Soc., Lond., for 1867, page 934, as *Ostrea purpurea*, Hanley, a variety of *Ostrea edulis*, of Linn., and did so on Mr. Hanley's authority—an authority of no mean importance, and which should have great weight in determining this vexed question. It has however, since been created into a distinct species by Sowerby, and I am willing to adopt this decision as final. Sowerby says that the sculpture of it is much less coarse than in equally large specimens of *Ostrea edulis*, Linn., and the upper valve is more convex than in *edulis*. Angas says that it differs from *edulis* by the laminate scales being much larger and more regularly filled, and the valves are dentate at the margins.

The largest specimens of this species found in the waters of New South Wales measure about six inches in diameter.

This species is now comparatively very rare, I say comparatively, for judging from the masses of this shell in the old camp ovens of the aborigines, along the shores of our river mouths and bays, it must have yielded an abundant supply of food in former days to those tribes which have now almost disappeared from amongst us.

I am of opinion that this is the same species of shell as is found in Tasmania, and which is recorded in the list of Tasmanian shells by the Rev. J. E. Tenison-Woods as *Ostrea edulis*, Linn.; the specimens found in Tasmania however are much larger and more ponderous than the shells of those found here; some from Tasmania exhibited at the late Universal Exhibition in Sydney, measured over seven inches in breadth. By adopting the name of *Angasi* we get rid of the species, *O. edulis* and its varieties, *O. purpurea*, and *O. rutupina* from our list. It is now extremely rare to see this species exhibited for sale in the shop windows of our fishmongers, which is to be regretted, as it is considered by many of superior quality to our other oysters; it would be well worth

while to attempt to cultivate so fine a species in its native waters, otherwise it is probable that it will soon altogether disappear. The variety of it diagnosed by the Rev. J. E. Tenison-Woods as *O. rutupina* of Jeffrey's is still plentiful in some of the Tasmanian waters.

Ostrea edulis of Linnæus, is not recorded by Reeve as being found in any other locality except Europe, but he instances five varieties as arranged by Jeffreys of it.

1. *O. parasitica* of Turton, adhering by a large part of its under surface to shells &c.

2. *O. hippopus* of Lam, not gregarious like the ordinary form but solitary, and living in deep water.

3. *O. deformis* of Lam., including those varieties elongated perpendicularly or laterally.

4. *O. rutupina* of Jeffreys, a small regularly formed, not very flaky variety, known as "Natives."

5. *O. tincta* of Jeffreys, like the last regularly formed and flat, but differing in having the sides coloured with purplish brown.

It is difficult to understand why so able a monographer as Reeve has omitted to mention in any way the variety *purpurea* of Hanley, either as a synonym of this species or any other, or has not recorded it as a distinct species, which Mr. Angas considered it.

2. Ostrea subtrigona, *Sowerby*.

Figured in Reeve's Conch. Icon., pl. xviii., sp. 38, fig. 38, a. b. and described as follows:—"Shell subtrigonal, oblong or subquadrate, ponderous, rather narrowed towards the umbones broad at the ventral margin, quadrate; margin strongly plicated lower valve deep, greenish white, edged (slightly) with purple, without radiately plicated, concentrically banded with fawn and

purple ; hinge acuminated, sides crenulated near the hinge. The sculpture of the shell is bold and large, and the square character of the ventral margin is striking."

The habitat given by Reeve is Australia.

This undoubtedly is our drift oyster, dredged so abundantly in beds at the mouths and in the channels of the rivers emptying themselves on the East Coast, and now so valuable an article of export from this city to the neighbouring colonies.

Ostrea subtrigona of Sowerby may justly be placed as the second species of importance—if it should not take first position—found in the Australian waters, it is the "drift oyster" of the harbours of New South Wales, the oyster in most common use as an article of food throughout the whole of New South Wales, and largely exported to Melbourne, Adelaide, Brisbane, Tasmania and even New Zealand and Fiji.

It is difficult to account for the absence of this abundant and valuable species in the list of Conchifera from Port Jackson and the adjacent coasts as published by Angas in 1867, I can only conclude that he considered it one and the same species as our rock oyster, which he erroneously considered *Ostrea mordax* of Gould, whereas it really is *Ostrea glomerata* of Gould. This species has attained the name of Drift Oyster on the supposition that the beds which it forms itself into are shifted from one part of the bay or river to another by the influence of tides or storms ; these so-called beds are composed for the most part of free unattached individuals, or attached in masses to drift matter, or to each other by slight adhesion of the lower valve. It is always found in moderately deep water in beds well out in the stream and is never uncovered by the fall of the tide ; it lives in a zone considerably below the zone occupied by the Mud Oyster and Rock Oyster.

It is popularly supposed and believed that this and our common Rock Oyster are one and the same species, so confident are some

that such is the case, that oysters are gathered off our rocky shores in large numbers and are laid down in positions in which it is thought a bed of oysters would thrive similarly to the beds which are found of this species, and that they will there grow spawn and reproduce Drift Oysters; this is a great error, and a want of knowledge of the true habits of this species and our common Rock Oyster (*Ostrea glomerata*), has led to disappointment and loss in attempts which have been made to cultivate oysters as a commercial investment.

The spat from our Rock Oyster will never produce this species, and if this species is placed in a position where it is uncovered by every receding tide it wastes and dies, but if kept well immersed it will thrive, fatten and reproduce itself, especially if it is placed in a position where there is a good current of water. Again our Rock Oyster has been placed in a similar position to the natural beds of the Drift Oyster (*Ostrea subtrigona*) but always with disappointment; when our Rock Oysters are placed in such a position they will not thrive and fatten, and in fact will not live very long, but will live longer than if the Drift Oyster is placed in the natural position of the Rock Oyster, uncovered night and morning by the fall of the tide. This species is considerably preyed upon by other mollusks.

3. Ostrea glomerata, *Gould.*

The common Rock Oyster of this harbour. Mr. Angas has, as I have already pointed out erroneously called this species in his list of Port Jackson Shells, *Ostrea mordax* of Gould. The Rev. J. E. Tenison-Woods in his "Census of the Marine Shells of Tasmania," tells us of the existence of a Rock Oyster similar to the Rock Oyster of New South Wales, which he also calls *Ostrea mordax* of Gould; and Mr. Angas in his paper on the "Molluscan Fauna of South Australia" speaks of the common Rock Oyster of that locality as *Ostrea cucullata*, Born, and states that it extends from King George's Sound to New South Wales, (this is also

an error), and it is recorded by Hutton as the Rock Oyster of Auckland, but not found further south in New Zealand. The fact is this species has a very wide range, from King George's Sound along the Great Australian Bight to South Australia, thence all along the coasts of Victoria and New South Wales as far north as the Tweed River.

This oyster occupies a zone above any of the other species, it is seldom found in the zone occupied by the Mud Oysters, and certainly never in such deep water as that in which *Ostrea subtrigona* is found. Generally it is found adhering to the rocks considerably above low water mark, and in places in the upper Marine zone among the *Trochocochlea* and *Nerita*; it varies much in form and appearance, at times being beautifully and delicately edged with a frill of a purple hue, at other times it is large hooded and unfringed at the edge, the latter forms are generally the best oysters.

If individuals of this species are placed in proper trenches or in positions where clear fresh sea water will flow over them at each tide, they thrive and fatten to an extent which makes them a valuable article of food, and an important commercial product; and by placing low stakes of wood or other material for the spat to adhere to when emitted from the mother shell, they are easily and successfully propagated; but when placed in such positions, especially on mud-flats which are uncovered by every tide, they are liable to the attack of a number of other Mollusks, and unless the water which flows over them is pure and free from decomposed vegetable matter and grit, they suffer from irritation caused by such particles, some discolor and waste, others die, and considerable loss may occur to the Cultivator from causes which may or may not be within his control.

The following is Reeve's description of this species:—"Shell thick, irregular, sharp-ribbed with the margin dentated or lobed, very inequivalve; upper valve opercular, compressed, wrinkled

with thick concentric laminæ; lower valve cucullated, purple-white within edged with purple or black; lateral margins denticul, ated; hinge generally attenuated, produced, pointed."

Having made a very careful examination of our common Rock Oyster and compared it with the description of this species and that of others, I conclude that our Rock Oyster must be referred to this species; it is not *Ostrea cucullata*. The only other species which it could be referred to is the one which it was referred to by Mr. G. F. Angas—*Ostrea mordax* of Gould. The latter is acutely denticulated within between the lobes, and the border between the denticles is of a deep purple brown; these characters are the most important and are not found in our common Rock Oyster as they are in the Oyster adhering to the rocks on the eastern shores of Queensland.

I do not concur with Reeve in looking upon *Ostrea spinosa*' Quoy, as possibly a young of *O. glomerata* or *O. cucullata*; the young of these two species never approach that form.

4. OSTREA MORDAX, *Gould.*

This species is a Rock Oyster found adhering very firmly to the rocks by the whole of the lower valve from Brisbane in Queensland to far North beyond Port Denison where probably it is found in greatest perfection; by consumers it is considered a great luxury and of finer flavour than any of our Southern species, it occupies a zone so as to be uncovered by the falling tide, which is very great in those localities.

The habitat of this species, is given doubtfully by Reeve as California, but it is not found there. Mr. John Brazier found it at Samoa, and at the Fiji Islands. It is also found at Port Denison, Queensland, and probably all along the coast north of Moreton Bay to Cape York, and at Lord Howe's Island, &c.

It is a compressed shell deeply lobed at the margins, between these lobes within it has acute denticles, and the border

between these denticles is of a deep purple brown; the hinge margin is straight and squared at the ends. Upper valve very flat, cinnamon-tinted within, variegated with purple between the denticles and margin lobes; lower valve thick and whitish within.

This is the species which Mr. George French Angas erroneously referred our common Rock Oyster to when he wrote his valuable list of the Marine Mollusca of Port Jackson Harbour and the adjacent coast.

5. Ostrea cristagalli, *Linneus.*

I am doubtful if this species should be included with the edible oysters, it is said to be freely eaten in Northern Queensland by the natives, and also in the South Pacific Islands, but I have not had any experience of it myself. I have specimens of it from Port Denison and other of the Northern Queensland Ports, and it is abundant in the Solomon and other Islands of the Pacific. It is known as the Cock's Comb Oyster. Figured in Reeve's Conch. Icon., Pl. xi., Species 22, Ostrea.

6. Ostrea imbricata, *Lamarch.*

Anim. sans Vert. Ostrea, No. 46. Figured in Reeve's Conch. Icon., Pl. xvii., sp. 36, a. b.

This Chinese species has recently been procured in fine condition at Port Denison, Queensland. I am not aware if it is an oyster which is used much as an article of food, but judging from its shell the occupant should be a delicious morsel.

It is a large foliaceous, thin shell, loosely radiately plicated, pinkish and ornamented with irregular purple spots, other shells are of a pale fawn, tinted with reddish brown; the lower valve often foliaceous.

7. Ostrea virescens, *Angas.*

Described in the Pro. Zool. Soc., Lon., 1867, p. 911, pl. xliv, fig. 13.

A suborbicular solid inequivalve shell, with the margins of the shell crenulately frilled, of a greenish-olive colour within, paler at the margins; the upper valve smallest, flattened, radiately plicate and laminately scaled, about $1\frac{3}{4}$ inches long and $1\frac{1}{2}$ broad. Found attached to rocks and Madrepores at the edge of low spring tides at Watson's Bay, Port Jackson.

This species is also well figured in Reeve's Conch. Icon. Mon., Ostrea, Pl. xi., sp. 23, fig. 23.

This is not a species likely ever to be of any commercial value, it is rare, and its green internal hue is uninviting.

8. Ostrea circumsuta, *Gould.*

United States Expedition. Figured in Reeve, Conch. Icon. Pl. xxvi., sp. 64, fig. 64, a. b.

The habitat given by Reeve, with doubt, of this species, is Massachusetts, but the fact that it is not included in the Marine Shells of the United States by Tryon, pretty clearly proves that this locality is a mistake. Mr. G. F. Angas was the first to point out that the species is found on those shores, he gives Botany Bay as the exact home of this shell, which statement I have much pleasure in endorsing; it is found there attached to rocks, not abundant, but specimens can easily be procured. It is about two inches long and one broad, and derives its name from the stitch-like appearance of the denticles in the upper valve, and corresponding indentations in the inner surface of the margin of the lower valve. It is whitish or purplish externally, plicated at the margin and tinted with purple or green within.

9. Ostrea discoidea, *Gould.*

Figured in Reeve, Conch. Icon., Pl. xiii., Fig. 26, sp. 26.

A rounded, flattened, finely striated, whitish-brown species, rayed with pale purple; valves almost equal, the lower one convex and the upper one much compressed; the hinge is comparatively small and contracted.

I have never seen this species, and neither Reeve or Hutton mention if it is an attached species or not.

Hutton gives the habitat of this species as Pelorus Sound, Catlin River, New Zealand. "A doubtful identification; perhaps the same as *Ostrea edulis*, Linn."—Hutton.

Reeve mentions that it is also found in Fiji.

10. Ostrea reniformis, *Sowerby*.

Figured in Reeve's Conch. Icon., vol. xviii., fig. 57.

"The Rock Oyster of Dunedin is referred with great doubt to this species."

Reeve in his Monograph records it as coming from Australia, which I think is a mistake.

11. Ostrea mytiloides, *Lamarch*.

Lamarch, in Animaux sans vertebres, Ostrea No. 21. Reeve, Conch. Icon., vol. xviii., fig. 3.

A parasitic species, solid, oblong, attenuated towards the hinge, plicato-crenated at the sides, deep violet, obscurely rayed, about four to five inches long, and two wide, generally attached to the Mangrove trees, and occupies a zone above low water mark in the bays and mouths of the Queensland Rivers. Mr. Brazier has a specimen of this species from Port Jackson.

12. Ostrea cucullata, *Born*.

Born, Mus. Ind., Cæs. Tab. vi., fig. 11, 12. Reeve, Conch. Icon., plate xvi., sp. 34, fig. 34, a. b. c.

I do not consider this an Australian species.

Reeve states that Hanley has referred this species, which is a very variable one to *Ostrea cornucopiæ*, Chemn., and *Ostrea Forskali*, Chemn., with which he agrees, but gives no habitat for it. I have included it in this list as it is to this species that

Mr. G. F. Agnas referred the Rock Oyster of South Australia when he wrote his paper on the "Marine Molluscan Fauna of South Australia," in 1865, p. 643, part ii.

It is found Mr. Angas says, common everywhere on rocks between tide-marks from King George's Sound to New South Wales; excellent eating and of a delicious flavour.

Two years after, when writing on the Marine Mollusca of Port Jackson and the adjacent Coasts, he does not include this species and refers our Rock Oyster in Port Jackson to *Ostrea mordax* of Gould, I presume he had altered his opinion on the South Australian species, and referred them both to *Ostrea mordax*, but I include them both under one and the same species—*Ostrea glomerata*, of Gould.

NOTES AND EXHIBITS.

Mr. Brazier exhibited the following specimens of *Cypræa* forwarded by Mr. J. F. Bailey of Melbourne—*Cypræa angustata*, *bicolor*, *declivis*, *piperita*, *Comptoni*, *annulus*, *Australis*, *oryza*; also the lower valve of a Corbula, named *C. sulcata*, by Mr. Bailey, but really belonging to *C. tunicata*, a species of wide distribution; also a *Clausilia*, collected in the Botanic Gardens, Melbourne, but evidently introduced with imported plants.

Mr. Ramsay exhibited the Fishes referred to in his paper, and specimens of *Rhomboidichthys pavo*, from the New Hebrides; a species of *Clupea* from Broken Bay; large specimens of *Galaxias Coxii*, from Mount Wilson; and a new species of *Virgularia* from Broken Bay; also a skull of a native of the Dawson River, showing a remarkable width of the dentary arches.

Mr. H. Selkirk exhibited a stone axe from the Kurrajong.

Dr. Cox exhibited a large block of wood which was taken out of a shaft which was sunk at Penrith a few weeks since. The